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THE FRANZ EDELMAN AWARD
Achievement in Operations Research

Introduction: 2023 Franz Edelman Award for Achievement in Advanced Analytics, Operations Research, and Management Science

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Abstract. This special issue of the *INFORMS Journal on Applied Analytics* (formerly *Interfaces*) is devoted to the finalists of the 53rd annual competition for the Franz Edelman Award for Achievement in Advanced Analytics, Operations Research, and Management Science, the profession's most prestigious award for deployed work. As in previous years, the finalists this year cover a wide range of industries and functions.

Keywords: OR practice • business analytics • OR implementation • OR success stories • Edelman Award

It is an honor for us to serve as chair and special-issue editor, respectively, of the 53rd annual international competition for the Franz Edelman Award for Achievement in Advanced Analytics, Operations Research, and Management Science. The 2023 competition was held on April 17, 2023, at the INFORMS Analytics Conference in Aurora, Colorado. Six finalist teams described how they applied operations research (OR) and advanced analytics to solve diverse and difficult decision problems. The problem domains include freight transportation and vehicle routing, cloud computing and live streaming, end-to-end supply chain management and resilience, real-time matching of drivers and riders for ridesharing, on-demand minute-level food delivery, and supply chain network design and load planning.

These entries highlight not only the high-impact models the proponents have created but also the remarkable and diverse ways these proponents have made advanced analytics modeling and analysis a part of strategic thinking and operational practice at their organizations. Three of the finalist teams are based primarily in the United States, and three in China. One of the teams includes authors from multiple countries.

About the Edelman Award Competition

The Franz Edelman Award competition is jointly sponsored by INFORMS and the INFORMS Section on Practice. The purpose of the competition is to bring forward and recognize outstanding examples of advanced analytics, operations research (OR), and management science

(MS) practice. The award is named in honor of Franz Edelman, who established one of the earliest industrial analytics and OR/MS groups in North America at RCA. He worked at RCA for more than 30 years and is counted among the fathers of innovation in analytics and OR/MS.

The Edelman finalist awards are for implemented work that has had significant, verifiable, and measurable impact. The impact may be beneficial to the organization winning the award (e.g., by increasing its revenues or reducing its costs) or to others (e.g., by improving their customer service or reducing overall environmental impact). INFORMS presents trophies commemorating the finalist awards to the client organizations that used the finalists' work and presents medals to the finalist authors. This year, the prize money totaled \$15,000, with \$10,000 going to the winner. More important, the finalists have the honor and satisfaction of knowing their work has been recognized by their peers as the best in the profession. In addition to having their efforts described in this special issue of the *INFORMS Journal on Applied Analytics*, all finalists have their presentations available at <https://www.informs.org/Resource-Center/Video-Library/Edelman-Competition-Videos>. The Edelman finalist presentations are also available on the INFORMS YouTube channel: <https://www.youtube.com/user/INFORMSonline>.

The Process

The Edelman Award process begins with a call for entries in the summer prior to the scheduled competition

date (in 2022 for this competition). The selection committee reviews all entrants and selects a set of semifinalists. Verifiers then work behind the scenes to validate the claims made by each semifinalist and to convey this information to the rest of the selection committee. Verification is performed by a mix of practice-oriented academics and full-time practitioners. The verifiers communicate directly with the entrant’s team, the users of the work, and client management. Support from client executives is important. Verification is a crucial element of the competition because it ensures that only the highest-achieving OR/MS and advanced analytics work makes it to the Edelman Award finals. All verifiers are provided with written guidelines and sample verification reports, and novice verifiers are paired with experienced verifiers.

The selection committee studies and discusses the verification reports to select six finalists. Coaches are assigned to each finalist team; these coaches help the finalists improve their papers and presentations for the competition. Typically, multiple iterations of paper and presentation drafts are required to clearly convey the work to a general INFORMS readership and audience within a limited number of pages and presentation lengths.

Judges study the papers, listen to the presentations, and then discuss the finalists’ accomplishments until they reach a decision on which finalist is most deserving of the Franz Edelman Award for Achievement in Advanced Analytics, Operations Research, and Management Science. Relevant factors include the overall impact and value of the application, the level of technical innovation, the difficulty of the obstacles surmounted, and the work’s portability to other application contexts.

The Finalists and the Papers in This Issue

Here is a summary of the finalists listed in the sequence in which their papers appear in this special issue.

Walmart for Optimizing Walmart’s Supply Chain from Strategy to Execution

Walmart is a leading retailer that operates a massive supply chain network, including 117 distribution centers, 26 fulfillment centers, 3 sortation centers, 96 transportation offices, around 600 Sam’s Clubs, and more than 4,700 stores, which cover 90% of the U.S. population within a 10-mile radius. Fast-changing demand patterns with its omnichannel transformation and the COVID-19 pandemic, keeping its Every-Day-Low-Price promise in an era of high inflation, and an already highly efficient network with no room for incremental improvement made it crucial to take a holistic approach from strategy to execution. Thus, Walmart developed an end-to-end optimization framework from strategic decisions for network design and transformation planning to operational

decisions for routing and load planning. The framework consisted of a set of scalable and fast optimization decision engines, utilizing innovative mixed-integer programming models and algorithms, metaheuristics, and a simulation capability to evaluate the impact of various scenarios. This next-generation system, adopted throughout Walmart’s entire U.S. grocery supply chain, helped prevent 98.6 million pounds of CO₂ emissions and save \$91.5 million by eliminating 108,000 truck routes covering 33 million miles in fiscal year 2023.

DHL Supply Chain for Innovative Integer Programming Software and Methods for Large-Scale Routing at DHL Supply Chain

DHL Supply Chain North America, operating one of the world’s largest logistics networks, delivers over one billion packages annually for corporate customers. Generating competitive bids to win customers’ business and improving existing supply chain designs were challenging problems that could not be addressed using off-the-shelf software with such a large-scale network. Thus, in collaboration with The Ohio State University, DHL developed a tailored transport network optimization (TNO) software suite encompassing four modules: freight optimization, fleet (sizing) optimization, pool point optimization, and round-trip optimization. These modules utilized innovative integer programming approaches and heuristics, including a new type of two-color ant colony search, dynamic programming, and genetic algorithms. Over two and a half years since its implementation in 2020, TNO has led to over \$117 million in estimated savings from reduced fuel, driver, capital, and outsourcing costs for DHL and its customers, contributing a 20% win-rate increase and reducing CO₂ emissions by at least 0.1 megatons.

Huawei Cloud for Huawei Cloud Adopts Operations Research for Live Streaming Services to Save Network Bandwidth Cost: The GSCO System

Huawei Cloud has been providing business-to-business livestreaming services in more than 60 countries since 2020. To support this global footprint, Huawei Cloud maintains a large-scale live streaming network that supports over 10,000 domains with more than 15 million simultaneous online end users globally. To minimize bandwidth cost while ensuring a high quality of service in light of a significant escalation in demand, Huawei Cloud, in collaboration with The University of Hong Kong, developed an innovative cost-effective traffic allocation system called GSCO, integrating forecasting, network planning, and sequential offline and online (real-time) traffic allocation. The system utilizes various operations research and machine learning techniques, including continuous optimization, integer programming, graph theory, and scheduling. GSCO helped

reduce network bandwidth costs by about 30% and led to savings exceeding \$49.6 million from quarter 1 (Q1) of 2020 to Q3 of 2022. It also facilitated an expansion of Huawei Cloud's market share with its peak bandwidth growing from 1.5 terabits per second (Tbps) to an impressive 16 Tbps.

JD.com for Supercharged by Advanced Analytics, JD.com Attains Agility, Resilience, and Shared Value Across Its Supply Chain

JD.com, the largest retailer in China based on revenue, offers more than 10 million stock keeping units and serves about 600 million active users via online and offline sales channels, with US\$149.3 billion of net revenue in 2021. Focusing on supply chain efficiency, supply chain resilience, and customer-demand intelligence, JD.com, in collaboration with Stanford University and The University of Hong Kong, implemented an end-to-end supply chain management system based on operations research and artificial intelligence (AI) techniques. This intelligent system includes a dynamic programming and a recurrent neural network-based inventory management model to improve operational efficiency, an emergency classification mechanism and simulation model in response to disruptions such as COVID-19, and an AI-based consumer-to-manufacturer system for accurately identifying consumer preferences and helping manufacturers design and produce products accordingly. The system led to billions of dollars in increased revenue and tens of millions of dollars in cost savings by the end of 2022, benefiting JD.com, its partners, consumers, and the entire ecosystem.

Lyft for A Better Match for Drivers and Riders: Reinforcement Learning at Lyft

A matching algorithm lies at the heart of a ridesharing platform, clearing the marketplace by connecting the riders and drivers of the market in real time as efficiently as possible. Challenged by the sudden drops in rider requests and drivers available during the COVID-19 pandemic, Lyft, in collaboration with Northwestern University, redesigned its core matching algorithm to keep up with the changing demand and supply patterns using an online reinforcement approach that could scale to the massive size of Lyft's ridesharing platform and handle thousands of requests every minute. This novel approach estimates the future earnings of drivers at any time and location in real time and uses this information to find more efficient matches. Using switchback experimentation in most U.S. markets, this approach was estimated to lead to more than \$30 million per year in incremental revenue, enabling drivers to serve millions of additional riders each year, benefiting riders, drivers, and the platform. Lyft rolled out the algorithm globally in 2021.

Meituan for Meituan's Real-Time Intelligent Dispatching Algorithms Build the World's Largest Minute-Level Delivery Network

Meituan, a leading on-demand food delivery service in China, delivers over 60 million orders daily utilizing its minute-level delivery network and over five million active couriers, ranking it as the world's largest in terms of order volume and courier count. Ensuring high-quality assignments is a critical objective for the delivery platform to maintain its service commitment to customers, delivering their food on time and exactly as ordered, while maintaining the delivery experience and efficiency of its couriers. Thus, Meituan, in collaboration with Tsinghua University, developed a real-time intelligent dispatch system, utilizing OR and machine learning techniques, to effectively model the assignment problem in a dynamic and uncertain environment, and generate high-quality solutions for this large-scale many-to-one assignment problem within 10 seconds. Since implementing this dispatch system in 2019, Meituan has realized a reduction of 20.96% in average delivery time per order and 23.77% in average courier travel distance per order, contributing to a cost reduction of about \$0.23 billion annually.

Conclusion

The Edelman finalists' papers make this issue of the journal special for both practitioners and academics. Practitioners can benefit in at least four ways. First, they will find better ways of accomplishing their work using advanced analytics models in a diverse group of organizations in both the private and public sectors. Second, they will find better ways to advocate their ideas to others within their organizations by pointing out the impact of adopting analytics modeling. Third, they will learn how to bring about change in an organization to make OR-based modeling and analysis an integral part of its culture. Finally, they can be inspired to tackle challenging problems and make the modeling choices necessary for their effective solution and deployment.

Academics will find validation of the advanced methodology they teach and will be able to demonstrate what can be achieved with OR/MS and advanced analytics. Furthermore, these examples illustrate how model customization is often required to suit the problem context.

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